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A CROWDED NEW SCHOOL AND A CRAZY CLASS SCHEDULE ARE ENOUGH TO MAKE IZZY DIZZY. It may be the first day of middle school, but as long as her best friends Allie Einstein and Charlie Darwin are by her side, Izzy knows it'll all be okay. But first-day jitters take an icy turn when Izzy's old pal Marie Curie gives her the cold shoulder and the school's air-conditioning goes on the fritz, dropping the temperature to near freezing. Cold classrooms and a frigid friendship? Izzy has had enough of feeling like an absolute zero. Sherallies the girls to use their brainpower and science smarts to tackle the school's chilly mystery ... and hopefully to fix a certain frozen friendship along the way.

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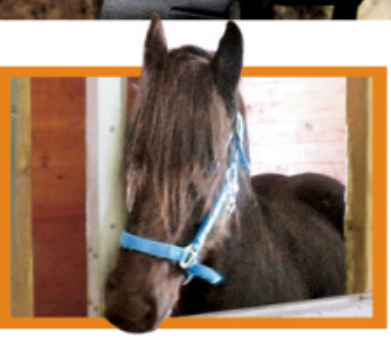
SPECIAL Super-Smart ISSUE

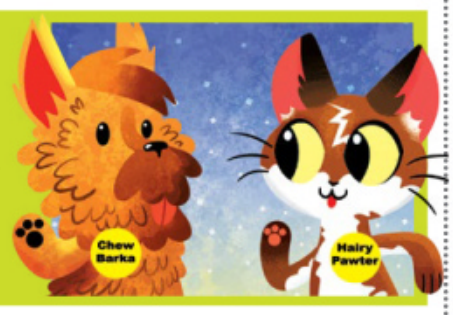
Boost your brainpower with this Special Supersmart Issue! Get started with a fun quiz on pages 12-13 to find out which type of genius you are.

CHECK OUT PAGE 14 TO FIND OUT ABOUT BRAINY ANIMALS LIKE JESSIE THE RED FOX AND THE MOUNTAIN GORILLA BELOW.

14 Animal Geniuses
These critters show surprising smarts.

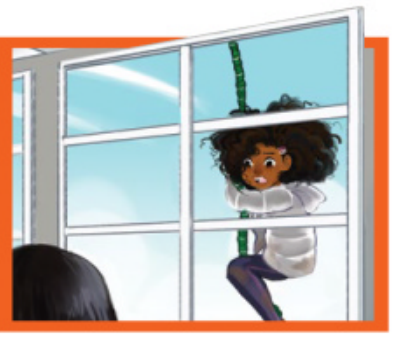


20 10 Brainy Questions
We've got answers to some of your biggest, weirdest questions.



24 Dare to Explore
Discover how quick-thinking scientists help protect the planet.

26 Sneak Peek!
Check out a chapter from *Izzy Newton and the S.M.A.R.T. Squad: Absolute Hero.*



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COVER: BREUER WILDLIFE / MINDEN PICTURES (FOX); JAMES ELLERKER / GUINNESS WORLD RECORDS (CAT); ALICE BRERETON (ALIEN ILLUSTRATION); SORANOME / SHUTTERSTOCK (ELEPHANT). PAGE 3: SIMON CZAPP / SOLENT NEWS AND PHOTO AGENCY (FOX); COURTESY OF SANDY AND DON BONEM (HORSE); © CHRISTOPHE COURTEAU / NATURE PICTURE LIBRARY (MOUNTAIN GORILLA); ALICE BRERETON (DOG AND CAT ILLUSTRATION); CARSTEN PETER / NATIONAL GEOGRAPHIC IMAGE COLLECTION (VOLCANO); GENEVA BOWERS (IZZY ILLUSTRATION)

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weird but true!

Check out these outrageous facts.

BY MARILYN TERRELL

CHECK OUT THE BOOK!

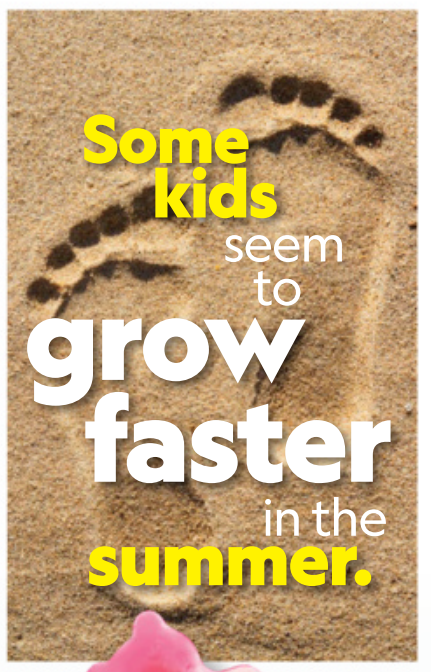
A group of **rhinos** is sometimes called a **crash.**

Camels are **originally** from **North America.**

Every year, HAWAII moves about 3 inches closer to ALASKA.

Plants need **10 bathtubs full of water** to grow enough cotton to make a **T-shirt.**

To keep from **drifting apart,** sleeping otters may **link paws.**



Some kids seem to **grow faster** in the **summer.**

A snail can **crawl** along a **razor's edge** without **cutting itself.**

A candy company makes **gummy bears** the size of **footballs.**

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INCREDIBLE ANIMAL FRIENDS

BY KITSON JAZYNKA

PUP BABYSITS PIGLETS

Oranienburg, Germany
The litter of boar piglets living at the Lehnitz Animal Sanctuary loved trying to get piggyback rides from their best bud, Baby the French bulldog. "Sometimes when the animals romped around, one of the boars would try to scramble onto Baby's back," sanctuary worker Norbert Damm said. "Baby would playfully shake the piglet off."

The football-size boars arrived at the sanctuary where the dog lived after they were found alone and freezing in a nearby forest. When the pooch saw the shivering newborns, she ran right over. "Baby cuddled with them, just as their mom would've done," Damm said. The pup stuck close to the pigs from then on.

Eventually the boars moved to a nature reserve. But for a while the fuzzy crew enjoyed dashing around the garden together, play-hunting, and snuggling for naps. "The animals just loved hanging out," Damm said. Guess you could say these guys were hog wild about each other.

FRENCH BULLDOG

WEIGHT 19 to 28 pounds

ORIGIN Most experts believe England

EXTREME POOCH These dogs can switch direction in midair.

GET AN EARFUL French bulldog ears are often called "bat ears" because of their appearance.

WILD BOAR

WEIGHT Adults can weigh between 110 and 770 pounds.

RANGE Originally Europe, Asia, North Africa; later introduced throughout the world

PIG DIG Mama pigs dig nests in grass to hide newborns.

TUSK-TUSK Wild pigs may have three- to five-inch-long tusks.

ASSOCIATED PRESS (BOTH)

GUINNESS WORLD RECORDS

BY ANGELA JONES

ITTY-BITTY KITTY

CUTE THINGS COME IN SMALL PACKAGES.

Lilieput may be the world's shortest cat, but she doesn't let her other feline friends get in her way—she just runs right under them! Lilieput, who is a breed of cat known as a munchkin, is less than six inches tall at her shoulders. That's barely taller than a soda can.

EYE-POPPING RECORD!

Your eyes might bulge when you see this. Kim Goodman can pop out her eyes almost a half inch beyond her eye sockets. Goodman discovered the talent when she was accidentally hit on the head (she wasn't hurt) and now can pop her peepers anytime she wants. This is definitely something you have to see to believe.

BURJ KHALIFA, DUBAI, UNITED ARAB EMIRATES
CN TOWER, TORONTO, CANADA
CHRYSLER BUILDING, NEW YORK CITY
EIFFEL TOWER, PARIS, FRANCE
ATOMIUM, BRUSSELS, BELGIUM

TOWER OF TOOTHPICKS

It makes sense that the world's tallest toothpick structure looks like the world's tallest building. Stan Munro used more than 250,000 toothpicks and three gallons of glue to create a 16-foot-8-inch replica of Burj Khalifa, a 2,717-foot tower in Dubai, United Arab Emirates (a country in the Middle East). Munro built his wooden structure in four main pieces, which took three people and two ladders to assemble. Hope he keeps it away from any strong breezes.

JAMES ELLERKER / GUINNESS WORLD RECORDS (LILIEPUT); KEVIN SCOTT RAMOS / GUINNESS WORLD RECORDS (TOOTHPICKS); DREW GARDNER / GUINNESS WORLD RECORDS (GOODMAN). INFORMATION PROVIDED BY © 2020 GUINNESS WORLD RECORDS LIMITED.

Bet You Didn't Know!

6 out-of-this-world facts about Earth

BY ERIN WHITMER

1 If you traveled as **fast** as a car on the highway, it would take nearly **3 days** and nights to reach the **Earth's core.**

2 About **3,000 lightning flashes** occur on Earth every **minute.**

3 More than a **thousand Earths** could fit inside **Jupiter.**

4 Earth's temperature **rises slightly** during a **full moon.**

5 **Humans have lived on** Earth for about **300,000 years; dinosaurs walked the planet** for roughly **160 million years.**

6 **Earth's longest mountain range is under the sea.**

YEVGENIY11 / SHUTTERSTOCK

BRAIN CANDY

BY JULIE BEER AND CHELSEA LIN

A LOT CAN HAPPEN IN

ONE MINUTE.

NIAGARA FALLS STRADDLES THE UNITED STATES AND CANADA. THIS VIEW IS FROM THE CANADIAN SIDE.

CHECK OUT THE BOOK!

IN 60 SECONDS ...

... **A HUMMINGBIRD** CAN **FLAP ITS WINGS** AROUND **4,000 TIMES.**

... **189,600 TONS** OF **WATER** FLOW OVER **NIAGARA FALLS.**

... YOU WILL **BLINK 15 TO 20 TIMES.**

... THE **CURRENT WORLD CHAMPION** CAN **SOLVE A RUBIK'S CUBE 12 TIMES.**

... THE **AVERAGE THIRD GRADER** CAN **READ** ABOUT **150 WORDS.**

TR PHOTOS / SHUTTERSTOCK (WATERFALL); STEPHEN RUSSELL SMITH PHOTOS / SHUTTERSTOCK (HUMMINGBIRD); PETER VRABEL / SHUTTERSTOCK (CUBE); MIK122 / GETTY IMAGES (BOOKS)

AMAZING ANIMALS

Silly Seal Sniffs Eel

Lisianski Island, Hawaii
This seal *nose* a thing or two about getting into trouble.

The Hawaiian monk seal pup was spotted lounging on the beach—with an eel hanging out of its nostril. Scientists approached the seal, gently held it down with their hands, and then pulled the two-and-a-half-foot dead eel out of its nose in about a minute. "The seal didn't feel any pain," says Charles Littnan, director of the Protected Species Division at the National Oceanic and Atmospheric Administration in Hawaii. "In fact it didn't seem to care at all."

Scientists have since found three other young seals with eels in their noses—and they don't know why. But since eels are on the seals' menu, the mishap probably happened when the youngsters were hunting. "The pups aren't sure how to handle their food yet," Littnan says. "And they seem to be good at getting into trouble."

Looks like these seals need to learn not to play with their food!

—Brandon McIntyre

Ape Takes Boat for a Ride!

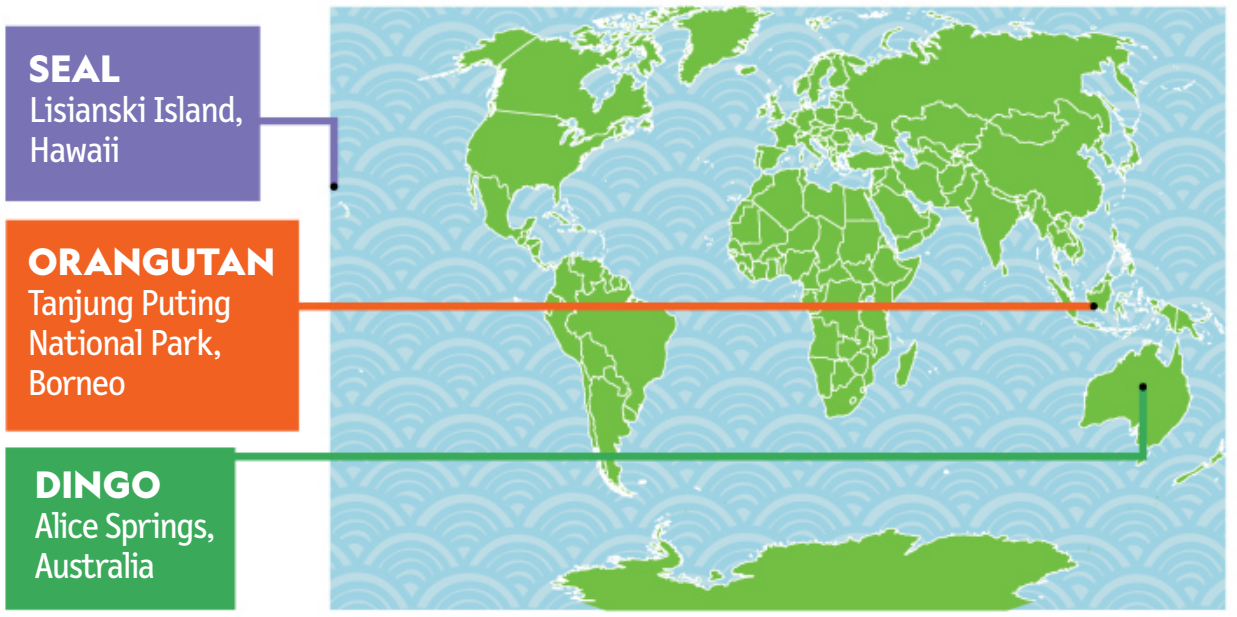
Tanjung Puting National Park, Borneo
Keep an eye on your vessel when Princess the orangutan is around. The boat-napping buccaneer steals canoes from the dock at Camp Leakey, the orangutan research station where she lives. Princess takes the boats so she can get to the tasty plants that grow downstream. But this sneaky great ape may have another motive: "If people are around, sometimes she does it to show off," says scientist Biruté Mary Galdikas, Camp Leakey's orangutan expert.

Princess' rides can be a royal pain for camp workers, who must retrieve the canoes she abandons. To discourage her, they store the canoes underwater. But Princess simply tips the boats from side to side until the water sloshes out.

All primates are intelligent, but Princess is especially brainy. "I'd say she's one of the smartest orangutans I've ever seen in my life," Galdikas says. Even when Princess is on shore, she eats like a queen: She figured out how to use a key to unlock the camp's dining hall! —*Deborah K. Underwood*

Singing Dingo

Alice Springs, Australia
He might not have been a famous pop star, but Dinky the dingo sure could belt out a tune! After innkeeper Jim Cotterill helped rescue the young wild dog from a trap in the Australian outback, he noticed that his new pet liked to "sing along" with the piano. When guests would play a song, Dinky would hop on top of the keys and howl a tune to match the notes. "A group of musicians told me that Dinky actually had pretty good pitch," Cotterill said. "When the notes went higher, so did Dinky's voice." —*Amanda Pressner*



BRITTANY DOLAN / NOAA FISHERIES (SEAL); BARCROFTMEDIA (PRINCESS); BARRY SKIPSEY (DINKY)

Welcome to the

SPECIAL Super-Smart ISSUE

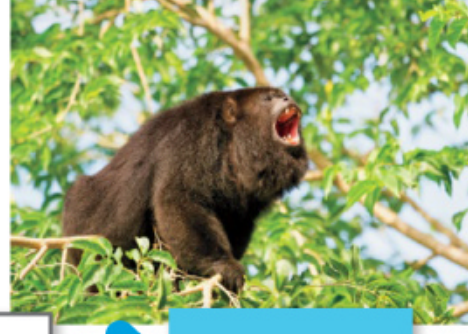
PERSONALITY QUIZ

BY KAY BOATNER

This **Special Supersmart Issue** is here to help boost your brainpower. The next 12 pages are crammed with clever critters, 10 crazy questions you *definitely* need to know the answers to, and behind-the-scenes secrets from smart Nat Geo explorers. Plus find out more about *Izzy Newton and the S.M.A.R.T. Squad: Absolute Hero*, a new book about five brainy buds starting middle school together.

But first, take this fun personality quiz to see which type of genius you are—and which *Izzy* character you're most like. Then start flipping to unleash your inner smarty-pants!

CURLED UP INDOORS WITH A GOOD BOOK OR MOVIE



Would you rather spot howler monkeys in rainforest treetops or sea otters in ocean kelp forests?

HOWLER MONKEYS

SEA OTTERS

How would you rather spend a rainy day?

SCIENCE FAIR

BRING ON THE OUTDOOR FUN!

One of these snacks has got to go. Which do you ditch?

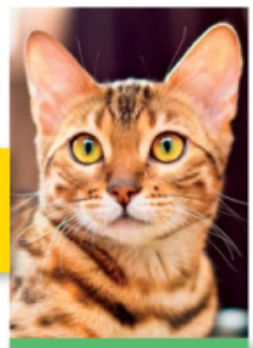
POPCORN

COOKIES

START HERE

Choose a contest to enter.

PHOTOGRAPHY COMPETITION



CATS ARE THE COOLEST.

You can move anywhere in the world. What's your dream destination?

I'LL SEE YOU IN TAIPEI, TAIWAN.

AUCKLAND, NEW ZEALAND, HERE I COME!

OOH, AN EXTRA EYE.

#TeamCat or #TeamDog?

DOGS, DUH.

Would you rather have a third eye or two noses?

SUPER SMELL, I GUESS.

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18+

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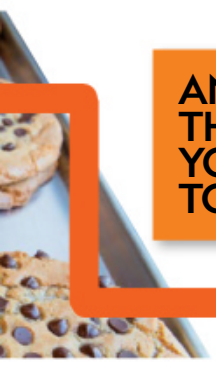
A WEATHER CONTROLLER (TO CREATE UNLIMITED SNOW DAYS!)

Pick a futuristic invention.

A WATCH THAT LETS YOU TIME TRAVEL

AN APP THAT HELPS YOU TALK TO ANIMALS



Pick one new body part: fur as warm as a baby harp seal's or protective quills like a porcupine?

QUILLS, COOL!

FUR, FOR SURE.

Choose a fashion statement.

SNEAKERS YOU'VE SKETCHED ON

A SPACE-THEMED BACKPACK

YOUR RESULTS

If these descriptions don't match your personality, don't worry. These questions are just for fun.

YOU'RE A PHYSICIST!

Some people get overwhelmed by a lot of information, but not physicist Isaac Newton, and not you. (Newton came up with the three laws of motion, aka the foundation of modern physics. No big deal.) A quick thinker, you're always chosen first for trivia teams but do your best to include everyone.

Izzy character match: IZZY NEWTON

The unofficial leader of the S.M.A.R.T. Squad ("S.M.A.R.T." stands for Solving Mysteries And Revealing Truths), sensitive Izzy is an excellent listener and loves cheering for her friends, no matter what challenge they're facing.

YOU'RE A MATHEMATICIAN!

Nerding out over numbers is so Albert Einstein—and so you! Einstein was a problem solver, contributing equations to calculus and geometry. Like him, if there's a problem, you try to solve it. You like that math problems have only one answer, but you're flexible and open to new experiences.

Izzy character match: ALLIE EINSTEIN

The most outgoing member of the S.M.A.R.T. Squad, Allie has affectionately been nicknamed "Allie Oops" because she's, um, pretty clumsy.

YOU'RE AN EXPLORER!

Your motto: "I'd rather be outdoors." Who needs air-conditioning when you can have a sea breeze instead? Like naturalist Charles Darwin, you're also an animal lover. (Darwin actually discovered several new species, in addition to coming up with the theory of evolution.)

Izzy character match: CHARLIE DARWIN

Charlie loves working with her family in their vegetable garden. She's also an amazing athlete.

YOU'RE AN ARTIST!

Sort of like a chemist who experiments with elements to help others, you love making things to inspire others. Whether through music, photos, or drawing, you're all about finding different ways to express yourself.

Izzy character match: MARIE CURIE

Marie—named after the chemist who discovered two chemical elements—is the S.M.A.R.T. Squad's gifted artist. She also loves fashion and experimenting with new looks.

YOU'RE AN INVENTOR!

You're a logical yet creative thinker with tons of patience: the perfect tools for inventing stuff. Just like inventor George Washington Carver, who invented hundreds of products, you figure out how to make things better. That means improving a gadget or helping a friend in need.

Izzy character match: GINA CARVER

Like her namesake, Gina is always thinking about how things *could* be instead of how they are. She's also a little messy and all about recycling.

GET THE SCOOP ON IZZY AND HER BRAINY BUDS.
smartsquadbooks.com

WHERE'S MY CAMERA PHONE?
141RC
Manfrotto

ANIMAL GENIUSES

These smart critters will surprise you.

BY ALINE ALEXANDER NEWMAN

Chickens are dumb. If there were an intelligence ladder, they'd be perched near the bottom. Foxes would sit on a rung higher than turtles. And chimps would outrank all animals except humans—who rule from the top.

At least that's how scientists *used* to think. But that thinking has changed. Why? Because no one can design an intelligence test that's fair for all creatures. Two-handed chimps can learn sign language. But robins can't—they only have wings. Goldfish would fail at tree climbing but earn A's in swimming. "I really don't make cross-species comparisons," says Marc Bekoff, a scientist from the University of Colorado in Boulder. "Dogs do what they need to do to be dogs, and foxes do what they need to do to be foxes."

That said, animals can demonstrate some surprisingly smart behavior. Keep reading for mind-boggling tales of animal brainpower.

A group of foxes is called a skulk or a leash.

JESSIE—REFLECTED IN THE BACKGROUND MIRROR—TOOK THIS PICTURE OF CZAPP.

SIMON CZAPP / SOLENT NEWS AND PHOTO AGENCY (JESSIE, BOTH)

FOX PHOTOGRAPHER

Jessie the red fox pup is curious. At New Forest Wildlife Park in Ashurst, England, she approaches photographer Simon Czapp the minute he enters her pen. Surprised, the photographer lets her sniff his shoes and stick her nose in his camera lens.

When Jessie stops, Czapp sets up a camera mounted on a tripod next to a tree stump. Then clutching a second camera, he steps back to watch. The little fox doesn't disappoint. She climbs onto the stump and examines the camera. "She looks so funny," says the photographer, who snaps picture after picture.

Later Czapp uploads photos from the shoot to his computer. Alongside his pictures are others he didn't take—they were taken by the fox! Jessie snapped herself reflected in a mirror, and she captured the photographer photographing her. "Technically my pictures were better," Czapp says. "But hers were nicely framed." Someone should give this furry shutterbug a selfie stick.

HORSE FORCE

Mariska the Friesian horse wants two things: freedom and extra food. Getting either requires finding a path through a series of locked doors in her barn in Midland, Michigan. So the clever mare often trots around and checks for fasteners she can undo. The other horses gather to watch as she slides bolts, twists handles, pushes doors, and lifts latches. Then they join her in galloping on the lawn or scarfing down grain kept outside the stalls.

As soon as owners Sandy and Don Bonem change the locks, Mariska figures them out. "She thinks things through and actually has a plan," Sandy Bonem says. And if one plan fails, Mariska devises another. Most recently the Bonems hung a new gate across the opening to Mariska's stall. Will that keep her confined? Time will tell. But for now the Bonems remain on guard, and for good reason. Mariska's sister is learning her tricks!

CLEVER CROCS

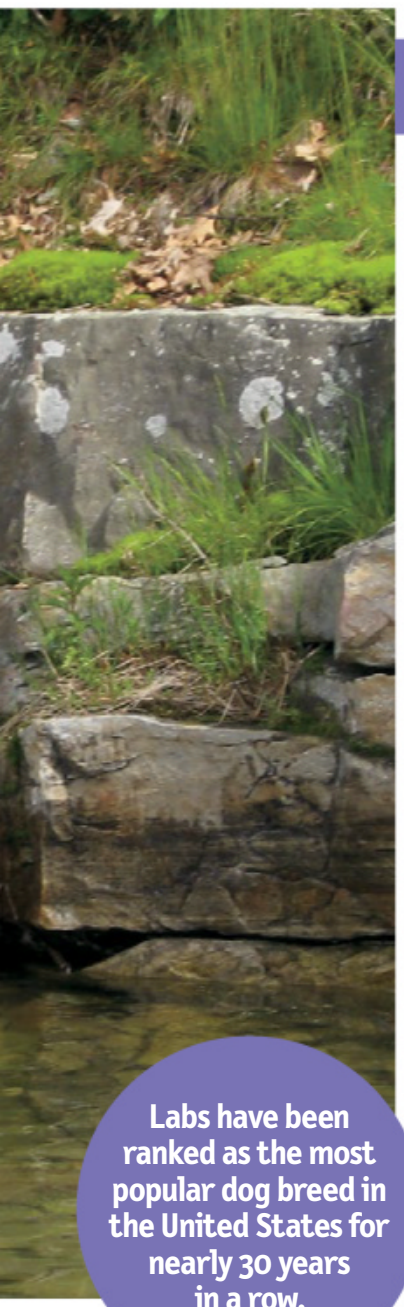
Scientist Vladimir Dinets is watching crocodiles in India. Some of them swim up under floating sticks and laze around for hours, balancing the sticks on their snouts. "I think it's just for camouflage," he says. But years later at Florida's St. Augustine Alligator Farm Zoological Park, he sees American crocodiles doing the same thing. Dinets notices a huge colony of nesting egrets nearby just as there was in India. Is there a connection between the crocs and these birds?

Intrigued, Dinets makes two discoveries. "The crocodiles tend to carry sticks near egret colonies, mostly at nest-building time," he says. Why? The crocs are using sticks as bait to lure the unsuspecting birds closer. Then when an egret reaches for a stick to add to its nest, the hungry croc quickly opens its large mouth. *Snap!* It's bye-bye, birdie! This means that Dinets's research proves that these crafty reptiles use tools.

TAKE A QUIZ TO TEST YOUR ANIMAL SMARTS!
natgeokids.com/september

Young crocodiles make high-pitched calls from inside their eggs when it's time to hatch.

A CROCODILE PILES STICKS ON ITS SNOUT TO ATTRACT NEST-BUILDING BIRDS.



Labs have been ranked as the most popular dog breed in the United States for nearly 30 years in a row.

DOG LOGIC

Ty the yellow Lab opens screen doors. He holds jars between his paws and twists their caps off with his teeth. And he raids the refrigerator so often that his family puts a lock on it.

One Labor Day, Ty goes with his owners to a neighborhood picnic on Round Island in New York's St. Lawrence River. He watches as people grill hamburgers and prepare sweet corn. Suddenly one woman throws up her hands. "Butter!" she yells. "I forgot the butter for the corn."

That's too bad. But folks make do without. Meanwhile, Ty wanders off. When he finally returns about 30 minutes later, his owner's mom, Marilyn Hutchinson, is completely shocked. "He must've understood what we were saying and gone searching from house to house," she says. Why does she think that? The proud pup is wagging his tail and holding a fully wrapped stick of butter in his mouth!

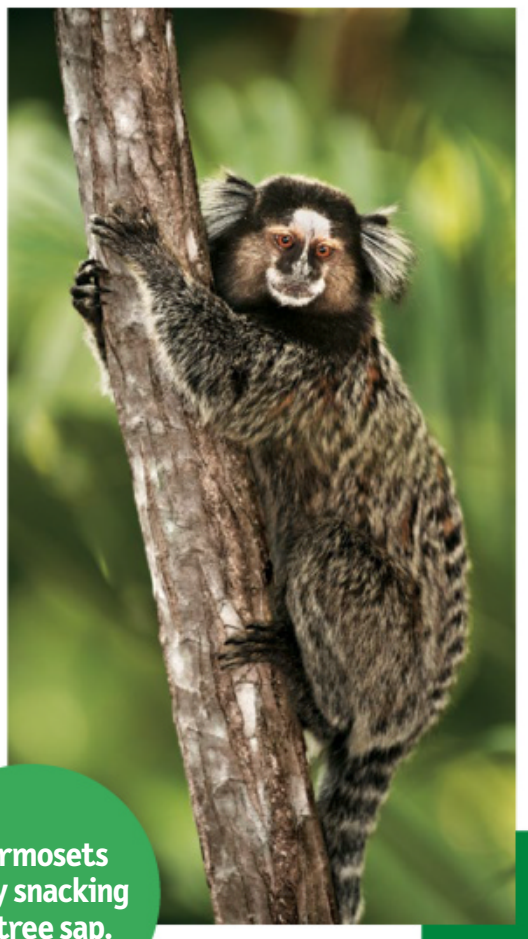
A GROUP OF MARMOSETS WATCHES AN INSTRUCTIONAL VIDEO SET UP IN A BOX.

MONKEY MIND

Some common marmosets—a kind of monkey—learn faster than others. But they're all good at learning from each other.

A wild marmoset called Alberto wants to open a box with bananas in it. He watches an instructional video that researcher Tina Gunhold-de Oliveira plays in Brazil's Atlantic Forest. Alberto puts his own twist on the instructions and creates a method that works. But it requires climbing on the box and pulling the lid open with his hand. Sometimes, while Alberto is on top of the box, another marmoset waits in front. Then that clever monkey steals the treat. "It's funny to watch," the researcher says.

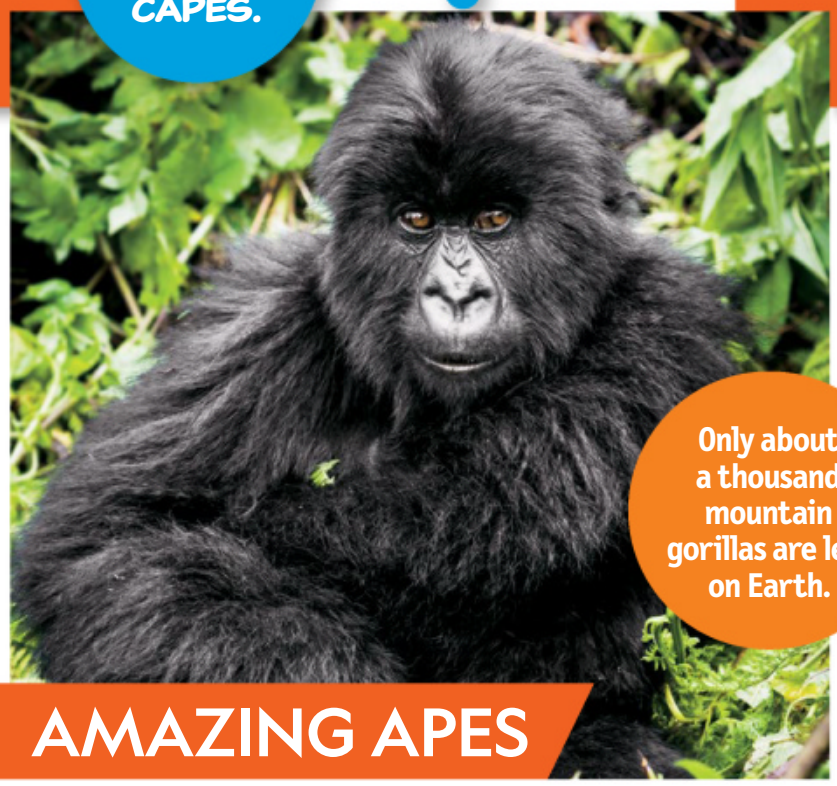
Katharina, a pregnant marmoset, is too tired to open the food box at first. But she pays close attention to the video of a marmoset demonstrating how to do it—by grabbing the knob of the drawer and pulling it open using both hands. After her twins are born, Katharina copies that technique and enjoys many goodies. "Social learning is crucial," Gunhold-de Oliveira says. And marmosets can learn from anyone—family, friends, even strangers on a screen.



Marmosets enjoy snacking on tree sap.

COURTESY OF SANDY AND DON BONEM (MARISKA); COURTESY OF MARILYN HUTCHINSON (TY); VLADIMIR DINETS, PHD (CROCODILE); TINA GUNHOLD-DE-OLIVEIRA, PHD (MARMOSETS IN BOX); © PETE OXFORD / NATURE PICTURE LIBRARY (SOLO MARMOSET)

NOT ALL HEROES WEAR CAPES.



Only about a thousand mountain gorillas are left on Earth.

AMAZING APES

Antelope hunters in Rwanda, a country in Africa, set snares by tying a noose to a branch, bending the branch down, and staking it to the ground. When an animal bumps a hidden stake, the branch springs upward, tightening the noose around its leg. But this time, an endangered three-year-old mountain gorilla has died after getting caught in the snare.

Days after the young ape's death, John Ndayambaje, a gorilla bodyguard with the Dian Fossey Gorilla Fund International, spots another snare in the forest. He quickly yanks up the rope.

Then, to his surprise, two gorilla youngsters suddenly leap forward. They finish dismantling that snare and, with another juvenile's help, destroy a second one that Ndayambaje hadn't even noticed. "They want to be sure there is no longer danger," he says.

"Gorillas are so like us," says Tara Stoinski, chief scientist of the Gorilla Fund. "They feel pain and help each other." For these smart apes, one tragedy is too many.

GORILLAS DESTROY TRAPS SET IN THE FOREST.

WATCH MORE CLEVER CREATURES IN ACTION!
natgeokids.com/september

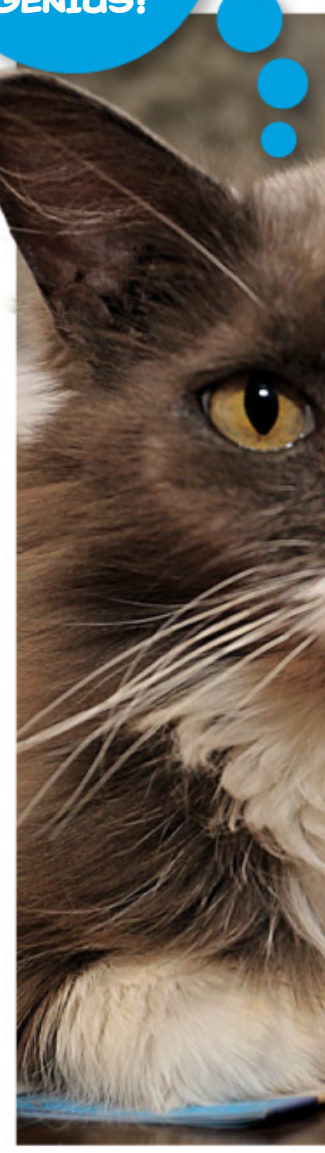
WHO NEEDS GPS WHEN YOU'RE A GENIUS?

BRAINY BFF

Nancy Cowen, 89, couldn't manage on her own. So relatives took her to Bramley House, a nursing home in Surrey, England. Soon after, staff noticed a Persian-cross cat hanging around the place. The creature spent three weeks peering in windows and sleeping on a patio table outside Cowen's room. "I thought she was a stray," caregiver Laura Costello said.

One night another employee picked up the cuddly kitty just as Cowen appeared in her open window. The cat scrambled free and bounded inside. "This looks like my cat, Cleo," Cowen said. "But my cat was missing her tail."

The employee turned the cat around—her tail was a stump! Cowen's relatives had given Cleo to the neighbors. But the pet left them and traveled over a mile to Bramley House, a place she'd never been. "It's extraordinary," Costello said. "We had no idea how Cleo found her owner." But everyone was glad that she did.



The kea is the world's only mountain-dwelling parrot.

NEO THE KEA USES HIS BEAK TO POINT TO WHICH HAND HE THINKS IS HOLDING A BLACK TOKEN.

Cats lack the ability to taste sweet things.

WHERE THEY LIVE

PARROT PREDICTIONS

This parrot's no birdbrain. When offered the choice between a black token and an orange token, Neo the kea—a type of parrot that lives only in New Zealand—chooses the black one. That's because over time, he's figured out that choosing the black token is more likely to get him a tasty treat!

Scientists have observed primates using math to make decisions in the wild—but no one had ever observed birds using math before. "We knew keas were smart," researcher Amalia Bastos says. "But we wanted to test their knowledge of probability, or their ability to figure out how likely an event would happen."

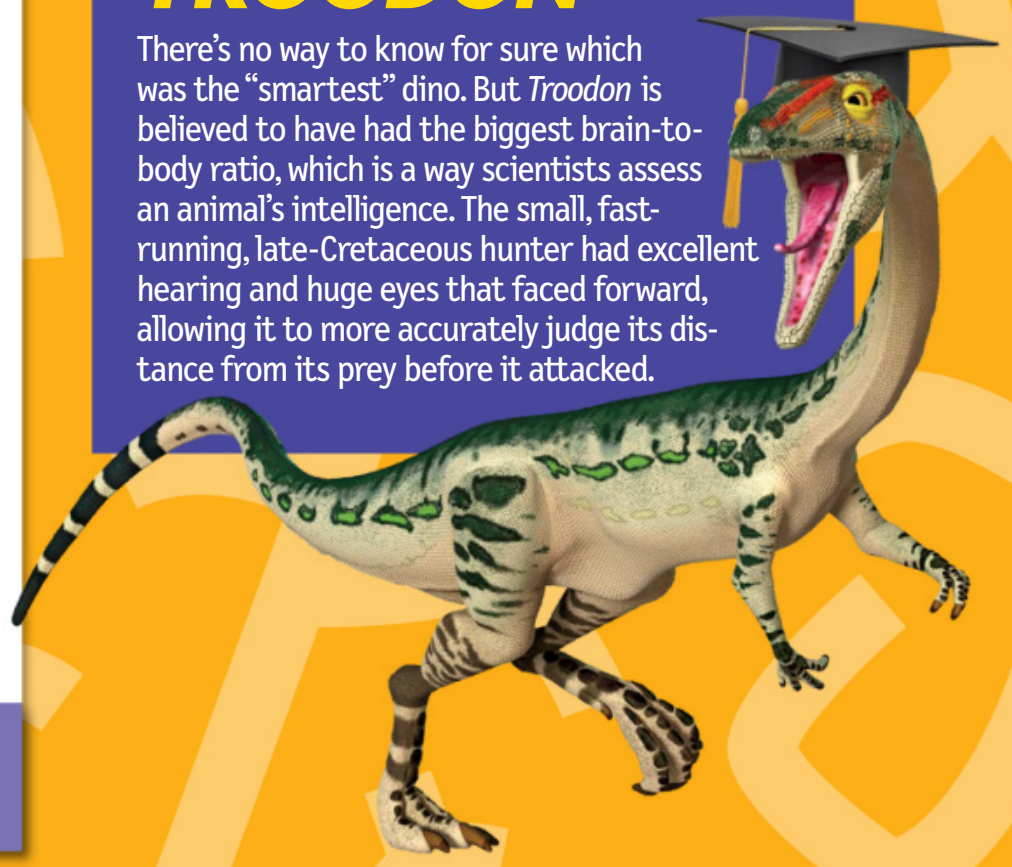
For the first part of the experiment, Neo and five other keas were encouraged to use their beaks to pick up black or orange tokens from the ground. They were given treats if they picked up black tokens, and nothing if they chose orange. Next, researchers mixed up the tokens in clear jars. They'd pick up one token from each jar and hide them in their palms before offering them to the birds. The keas preferred tokens from jars that had more black ones than orange, showing they were playing the percentages.

That makes keas the first animals outside of the great ape family (and humans) that use probability in their decision-making process. All those black tokens add up to some seriously smart birds.

MOST INTELLIGENT DINO EVER?

TROODON

There's no way to know for sure which was the "smartest" dino. But *Troodon* is believed to have had the biggest brain-to-body ratio, which is a way scientists assess an animal's intelligence. The small, fast-running, late-Cretaceous hunter had excellent hearing and huge eyes that faced forward, allowing it to more accurately judge its distance from its prey before it attacked.



© CHRISTOPHE COURTEAU / NATURE PICTURE LIBRARY (MOUNTAIN GORILLA MAIN, MAP INSET); DIAN FOSSY GORILLA FUND INTERNATIONAL (SNARE TRAP); GRANT MELTON (CLEO MAIN, MAP INSET); AMALIA BASTOS (KEA MAIN, MAP INSET); COURTESY OF SANDY AND DON BONEM (HORSE INSET); COURTESY OF MARILYN HUTCHINSON (DOG INSET); SIMON CZAPP / SOLENT NEWS AND PHOTO AGENCY (RED FOX INSET); © PETE OXFORD / NATURE PICTURE LIBRARY (MARMOSET INSET); BLICKWINKEL / ALAMY (CROCODILE INSET); VALENTYNA CHUKHLYEBOVA / SHUTTERSTOCK(TROODON), PIXFICTION / SHUTTERSTOCK (CAP), IMAGE DIGITALLY COMPOSED

10 Brainy Questions

HEY, SMARTY-PANTS!

GOT BIG, WEIRD QUESTIONS?

WE'VE GOT ANSWERS!

BY ALLYSON SHAW
ART BY ALICE BRERETON

1 Why do beaches have sand?

Sand is mostly mountains plus time. Over millions of years, wind and rain break off little pieces of Earth's crust. These bits travel through rivers and streams, getting smaller and smaller as they flow through water and bump against other obstacles. Eventually the bits reach the ocean, where waves smash them into even smaller pieces and push them onto the shore. But some sand, like on the beaches of Hawaii, is mostly made from parrotfish poop! Parrotfish nibble on algae growing on dead coral, and sometimes they accidentally digest the coral. Then they poop it out as sand. In fact, one parrotfish's tummy can grind up enough coral to create up to 800 pounds of soft, white sand a year.

2 Where does tap water come from?

You probably already know that the water you use to brush your teeth likely comes from a local water source like a lake, passes through a treatment facility, then heads to a storage tank and into your house. But you *might* not know that those same water molecules have been around since the Earth began. Some scientists think our water arrived 4.6 billion years ago as ice on meteorites that slammed into our still-forming planet. Ever since, those water molecules have been evaporating from oceans and lakes, condensing into clouds, and precipitating over and over. That means a *T. rex* might've once sipped the same water you did! (We'll let *you* figure out how the dino's drink made it back into the water cycle.)

3 Why do avocados exist if animals can't eat their seeds?

To make guacamole! Well, kind of. In the wild, new fruit plants can grow when animals eat their fruit then poop out the seeds. But avocados are too big for most animals to swallow whole—so how does the fruit still exist? You can thank extinct animals like giant ground sloths. Until about 10,000 years ago, these 15-foot mammals roamed the Americas, snacking on avocados and their pits. After they went extinct, scientists think that humans started planting avocado seeds to grow new plants. If they hadn't, avocado trees likely would have gone extinct too.

4 Why are ancient statues and buildings always white?

The paint has come off! Ancient Greeks and Romans painted their statues and temples in many different colors, but over the past few thousand years, the paint has worn away. Ancient artists mixed colorful minerals—like crushed-up malachite for green or azurite for blue—with beeswax or egg yolks to create paint. Today archaeologists are using ultraviolet and infrared lamps along with chemical analysis to discover the traces of colors and patterns left behind on the statues. And we know ancient people would approve: A line in one Greek play implies that wiping color off a statue would make it uglier.

PROVE YOUR SMARTS: TAKE BRAINY QUIZZES!
natgeokids.com/quizwhiz

5 How do monarch butterflies know where to fly?

Because of sunshine and magnets—in a sense, that is. Every winter, monarch butterflies fly up to 3,000 miles south to central Mexico—even though they've never been there before. The shorter days and cooler weather send a signal that it's time for the monarchs to migrate. As they travel, they use their large, complex eyes to look at the position of the sun, and their internal clock to tell them what time it is. They then use that information to figure out which way is south, since the sun changes position throughout the day. But what if it's cloudy? Monarchs can pick up on Earth's magnetic field lines—which run from the north of the planet to the south—to guide themselves on overcast days. The next big mystery scientists are trying to solve: How do the monarchs know when to stop?

6 What's the most anyone has counted out loud to?

One million! And you probably don't want to try breaking the record: Jeremy Harper counted out loud 16 hours a day for 89 days to reach his ginormous goal. Don't think a million seems all that big? You'd be 2,739 years old if you lived a million days and need about 286 pieces of paper to type out a million zeros. And a million jelly beans stacked on top of each other would reach twice the height that a commercial airplane flies.

7 Do pets know their names?

Yes—kind of. Pets don't speak human, but they do recognize sounds. One study has shown that pets know the difference between the names we've given them and similar-sounding words, even when said by a stranger. Scientists think that dogs and cats learn to listen for the sounds that make up their name because responding often means cuddles and treats. So why does your cat not always come when it's called? It likely knows its name—but it's probably ignoring you.

8 What's the farthest we've sent something into space?

About 13.8 billion miles! In 1977, NASA scientists launched two spacecraft, Voyager 1 and Voyager 2, to study the outer planets of our solar system and beyond. Today Voyager 1 is the farthest thing we've sent into the universe, while Voyager 2 is a still-impressive 11.5 billion miles away. Each far-flung vessel carries a gold-plated disc with messages for extraterrestrials. What would a traveling alien get out of us Earthlings? Music, whale calls, greetings in 55 languages, and photos of astronauts, airplanes, and kids in classrooms. Each disc also has playing instructions in case aliens ever find this high-tech message in a bottle.

9 What's inside the Great Pyramid of Giza?

Not much anymore! The Great Pyramid was built about 4,570 years ago as the final resting place of Khufu, an Egyptian pharaoh. It also stored all the stuff he'd need in the afterlife, like bread, fruit, furniture, clothes, and jewelry. The 481-foot-tall stone structure was Khufu's way of telling people that he was super important. But it also screamed, "Hey, stuff to steal inside!" Today you can walk through a passageway deep into the center of the pyramid until you reach the King's Chamber, which has a granite sarcophagus—but nothing else.

10 What do beavers smell like?

Freshly baked cookies! If you could get your nose close to a beaver's tail, you'd sniff a goo called castoreum that beavers use to mark their territories—and yep, it comes out of their butts. The slimy stuff smells like vanilla because of their diet of leaves and bark. Manufacturers have put this natural ingredient in perfumes and foods, but it turns out it's pretty hard to "milk" a beaver. Plus, it's kind of gross.

CHECK OUT THIS BOOK!

DARE TO EXPLORE

How quick-thinking scientists help protect the planet

BY KITSON JAZYNKA

SCIENTISTS FIT THIS MATSCHIE'S TREE KANGAROO WITH A TRACKING COLLAR SO THEY CAN STUDY ITS MOVEMENTS.

WANT TO BE A BIOLOGIST?

STUDY Biology, chemistry
WATCH *FernGully: The Last Rainforest*
READ *Quest for the Tree Kangaroo* by Sy Montgomery

THE BIOLOGIST

Lisa Dabek studies endangered Matschie's tree kangaroos to learn how to better protect them in the wild. She talks about tracking one on the island of New Guinea.

"I was with our local research team, trying to capture a tree kangaroo in a cloud forest, which is a rainforest high in the mountains. Like regular kangaroos, tree kangaroos have pouches and can hop, but they live in trees. We wanted to put a camera on one of the kangaroos so we could see what it did in the treetops.

"To find one, we looked for claw marks on bark and kangaroo poop on the ground. We finally spotted a kangaroo 60 feet up in a tree and cleared the area below of brush and waited. Then one of the locals climbed up. We knew the tree kangaroo would react by leaping down as if a predator were close. I held my breath. From way up high, the tree kangaroo spread its limbs, glided down, and landed on the soft, mossy ground. She let us gently put a camera collar on her before she hopped away. When the collar fell off five days later, we retrieved it and had footage of her munching on orchids and cleaning her pouch a hundred feet up in a tree!

"Little is known about these animals, and I want more people to discover them so we can save them together. If you're ever lucky enough to meet a tree kangaroo, you'll fall in love with it."

"Even the most difficult challenges always have solutions. I have asthma, but I figured out how to hike the mountains of Papua New Guinea."

ROBERT LIDDELL (TREE KANGAROO); JONATHAN BYERS (DABEK); THOMAS MARENT / MINDEN PICTURES (SLOW LORIS); DEVORE, SORA / NATIONAL GEOGRAPHIC IMAGE COLLECTION (MAJUMDAR); CARSTEN PETER / NATIONAL GEOGRAPHIC IMAGE COLLECTION (VOLCANO, PETER)

A SLOW LORIS SPENDS TIME IN ITS RAINFOREST HOME ON THE INDONESIAN ISLAND OF SUMATRA.

THE WILDLIFE WARRIOR

Onkuri Majumdar is a wildlife conservationist who works to save animals stolen from the wild in parts of Asia and Africa. She recalls rescuing slow lorises seized by smugglers.

"We should strive to make the world a better place, especially for wild animals that can't stand up for themselves."

"When I was working in Thailand, my team heard that slow lorises—primates that live throughout Asia—were being poached, or illegally taken, from the wild. They were being sold so tourists could take photos with them and share the images on social media. Poachers also sell the shy, small animals as pets.

"To catch the criminals, we trained a local police team to track them. I was there for the arrest and rescue operation to make sure the animals were recovered safely. You could tell the lorises hadn't been well cared for. We wrapped them in blankets to keep them warm, but they were so stressed, they chewed up the cloth. I was relieved to deliver the animals to a wildlife rescue center where caregivers would help the lorises get healthy again.

"Moments like saving those lorises are why I do my job. I want to help catch poachers and encourage lawmakers to pass laws against these terrible crimes."

WANT TO BE A WILDLIFE WARRIOR?

STUDY Veterinary science, law enforcement
WATCH *The Fox and the Hound*
READ *A Wolf Called Wander* by Rosanne Parry

THE ADVENTURER

Carsten Peter is a biologist who climbs sizzling volcanoes to photograph eruptions. He describes getting caught in the middle of a days-long eruption.

PHOTOGRAPHER CARSTEN PETER SNAPPED THIS PHOTO OF AN EXPLOSION ON MOUNT ETNA, A VOLCANO IN ITALY.

"Every volcano is as different as every human. Each one has its own character."

"A group of us were on an expedition on Mount Etna, a volcano in Italy. We hoped to photograph a paroxysm (pronounced puh-ROKS-ism). They're massive eruptions that produce fire mountains, or wild sprays of magma.

"We camped out halfway up the peak and waited. In the middle of the night a fissure, or crack, suddenly appeared in front of us. Ash and dust started swirling around, stinging our eyes. The smell of volcanic gases filled our noses, and volcanic lightning cracked in the air. The ground was so hot, the bottom of my friend's shoes melted.

"The eruption lasted for days. We decided to stay so we could document everything, even though we hadn't brought enough food. We saw several paroxysms. During calmer moments, we dug under cooled ash to find snow we could melt for drinking water.

"It's one thing to understand the science of volcanoes, but it's crazy to feel it up close. Not everyone can sleep on a volcano. That's why I do what I do—to show people the awesome power of nature."

WANT TO BE AN ADVENTURER?

STUDY Photography, environmental studies, geography
WATCH The documentary *Volcanoes: The Fires of Creation*
READ *Extreme Planet: Carsten Peter's Adventures in Volcanoes, Caves, Canyons, Deserts, and Beyond!* by Carsten Peter and Glen Phelan

WATCH SMART SCIENTISTS WITH COOL JOBS!
natgeokids.com/september

FROM THE PAGES OF

IZZY NEWTON AND THE S.M.A.R.T. SQUAD

ABSOLUTE HERO

BY VALERIE TRIPP ART BY GENEVA BOWERS

Izzy Newton has just started sixth grade at Atom Middle School. She can't wait to introduce her buds Allie Einstein and Charlie Darwin to her old friend Marie Curie, who's just moved back to town. But Marie doesn't seem as thrilled to see Izzy as Izzy is to see her.

In this excerpt from Izzy Newton and the S.M.A.R.T. Squad: Absolute Hero, *Izzy and her crew are investigating a broken air conditioner that's causing the school to feel like the Arctic. They head to the roof to use their science skills to solve the problem—and get stuck. It's up to Izzy to figure out how to escape without being reported to the principal.*

"Oh, no!" cried Izzy. She, Allie, and Charlie tugged on the door handle, but the door back into the building was stuck shut. It wouldn't open, no matter how hard the girls pulled.

"*Help!*" all three girls yelled. But there was no one around to hear their cries.

"What are we going to do?" asked Allie. "We could be stuck here all night!"

"I'm sure there's a way down," said Izzy. "Let's look for a ladder."

The girls searched the rooftop. When they met up again, Charlie had found a hose. "We can loop this around one of the air-conditioner condensers," she said. "I'll shimmy down."

"Wait!" said Izzy. "I'm the littlest, so I think I should be the one to go down."

"Are you sure?" asked Charlie.

"No," Izzy admitted. "I'm scared stiff. But you're the strongest, so it'll be best for you to stay here and hold on to the end of the hose, right?"

Charlie nodded.

The girls got to work. The hose was heavy, so it was tough to haul it over to the air-conditioner condenser, uncoil part of it, wind a few loops around the condenser, and then drag and drop the rest of it over the edge of the roof.

Charlie and Allie braced their feet against the condenser and took a firm hold on their end of the hose. Izzy, whose arms were already tired from wrestling with the hose, went to the edge of the roof and turned to face her friends.

She straddled the hose, grabbed it in both trembling hands, and loudly called out, "Bye!"

"Be careful, Izzy," cautioned Charlie.

Tentatively, Izzy lowered herself over the edge. *This is the stupidest thing I've ever done*, she thought.

The hose was slick and cold, so Izzy squeezed it between her knees and twisted it around her feet for extra grip. Inch by inch, she slid down the hose.

Izzy lowered herself down the dangling rope past the windows of a second-floor classroom, hoping the wind wouldn't smack her against the glass hard enough to shatter it.

Soon she was dangling in front of the windows of a first-floor classroom. Izzy looked in the windows and realized she was staring into the science lab—and staring back at her was *Marie*.

Izzy was so surprised that she lost her grip for a second and slid sickeningly out of control until she found a foothold on the windowsill.

Marie was gaping at her. All Izzy could do was smile as she dropped the last few feet to the ground. Her hands were so clenched that it hurt to straighten her fingers. But the pain was nothing in comparison to the worry: *Marie isn't my friend anymore, so will she tell on me?*

Izzy didn't have time to wonder. She had to free Allie and Charlie before someone else found them.

She flew through the chilly school building and up to the room that led to the roof. Izzy hurled herself at the door, and with all her strength tried to force it open.

Will Izzy be able to free her friends? Will Marie keep Izzy's secret? Check out *Izzy Newton and the S.M.A.R.T. Squad: Absolute Hero* to find out!

WIN THE BOOK!
GO ONLINE AUGUST 11-18.
natgeokids.com/september

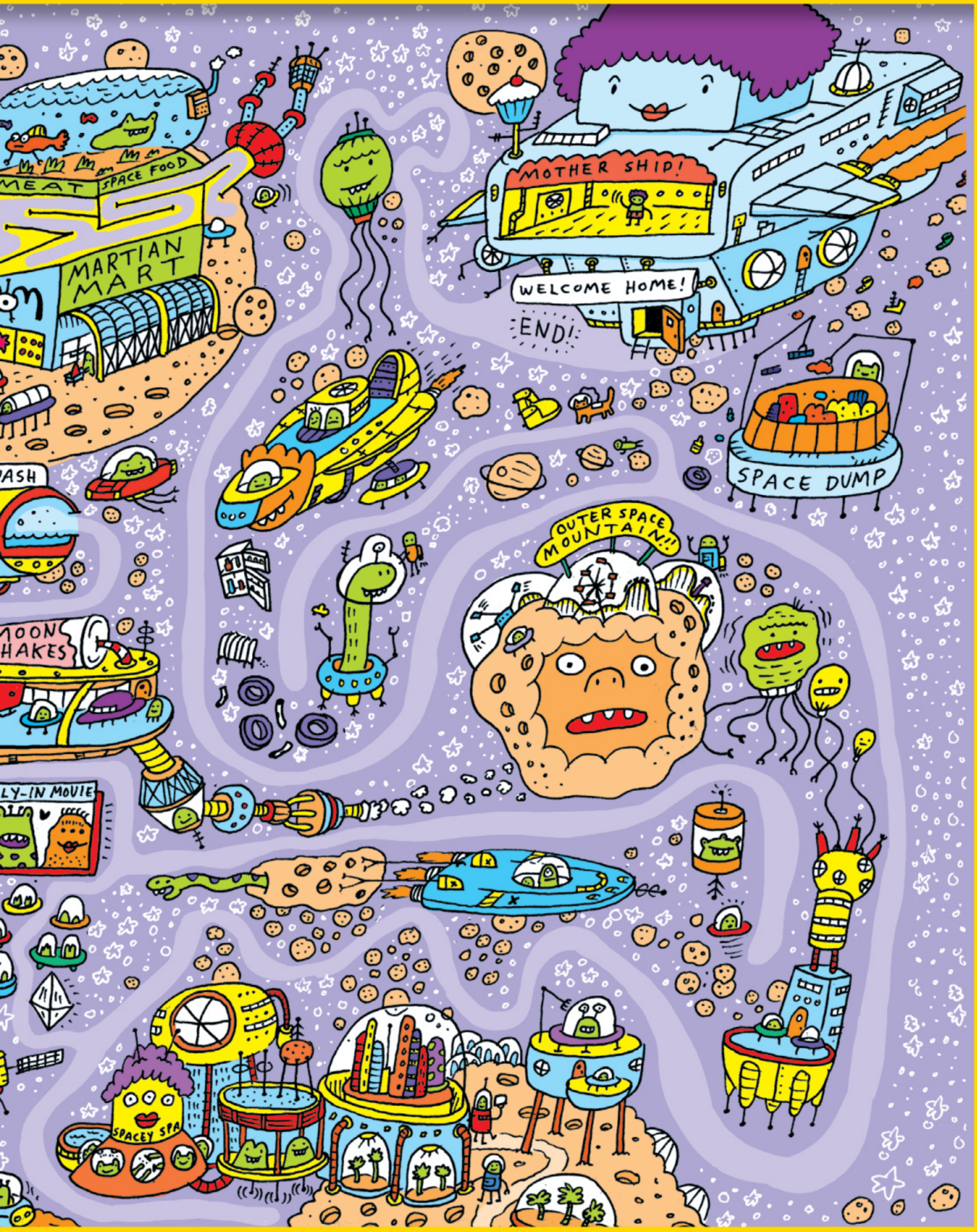
FUN STUFF

GAMES, LAUGHS, AND LOTS TO DO!

PLAY!

GALAXY QUEST

Help Zorg the alien find the starry path that leads back to the mother ship. ANSWER ON PAGE 33



CLAYTON HANMER

WHAT IN THE WORLD?

DOWN UNDER

These photographs show close-up and faraway views of things in Australia. Unscramble the letters to identify what's in each picture.

ANSWERS ON PAGE 33

DRSRBFUOSA

_____

RTEGA ARERIBR FREE

_____

ORNGAAKO

_____

AWSCYSAOR

_____

NREMBOGAO

_____

RULUU

_____

LAFG

_____

OAAKL

_____

DENYYS EORAP OESUH

_____

TOP ROW (LEFT TO RIGHT): SURFLOVER / SHUTTERSTOCK; FELIX MARTINEZ / GETTY IMAGES; © AGE FOTOSTOCK / SUPERSTOCK.
MIDDLE ROW (LEFT TO RIGHT): ANDY GEHRIG / GETTY IMAGES; KHARIDEHAL ABHIRAMA ASHWIN / SHUTTERSTOCK; LKPRO / SHUTTERSTOCK.
BOTTOM ROW (LEFT TO RIGHT): NILS VERSEMANN / SHUTTERSTOCK; © GARY BELL / OCEANWIDEIMAGES; © AGE FOTOSTOCK / SUPERSTOCK.

FUNNY FILL-IN

KA-CHING!

Ask a friend to give you words to fill in the blanks in this story without showing it to him or her. Then read out loud for a laugh. BY KAY BOATNER

PLAY MORE FUNNY FILL-IN!
natgeokids.com/ffi

_____ (silly expression)! I just received _____ (large number) billion dollars from my _____ (adjective) great-great-great-great-aunt for my birthday. I know exactly what I'll do with the _____ (noun). First I'll buy the _____ (favorite sports team). Maybe I could hire _____ (famous athlete) to be my _____ (type of job)! I'm going to have all my _____ (article of clothing, plural) made of _____ (noun, plural) and build a roller coaster in my new _____ (room of a house). I'll ride a(n) _____ (verb ending in -ing) _____ (type of transportation) to school—no more bus rides for me. And now I can get _____ (female friend's name) a(n) _____ (noun) like she always wanted. I think I'll even _____ (verb) a charity to save the _____ (animal, plural). I'm so rich, I can give my *parents* an allowance.

DAN SIPPLE

FROM THE PAGES OF *ALMANAC 2021:*

STUMP YOUR PARENTS

If your parents can't answer these questions, maybe *they* should go to school instead of you!

ANSWERS ON PAGE 33

1 **The idea that sparked the Hula-Hoop craze of the late 1950s came from _____.**
A. circular branches used by monkeys
B. tire rims used by Swedish kids
C. metal hoops used by factory workers
D. bamboo hoops used by Australian kids

2 **Most people lose _____ strands of hair every day.**
A. 75 **C.** 95
B. 85 **D.** 105

3 **In the Netherlands, it is most polite to eat your bread with _____.**
A. your hands
B. a knife and fork
C. your feet
D. chopsticks

4 **The pirate Blackbeard put _____ under his hat to scare captured sailors.**
A. black dye **C.** daggers
B. burning ropes **D.** rats

5 **What is Iron Man's true identity?**
A. Peter Parker
B. Scott Lang
C. Tony Stark
D. Bruce Banner

6 **Why do cats get stuck in trees?**
A. They like the view.
B. They're afraid of heights.
C. Their claws are curved so that they can climb *up* easily, but not down.
D. They're secret BFFs with birds.

7 **A group of adult alligators is called a _____.**
A. herd **C.** crash
B. congregation **D.** hive

8 **In which country do about half the highways have no speed limit?**
A. Switzerland **C.** Japan
B. Germany **D.** Botswana

9 **When asked by the Incredible family to design their superhero costumes, Edna Mode refused to include which accessories?**
A. capes **C.** belts
B. masks **D.** gloves

10 **In 1922, which cookie recipe were Girl Scouts encouraged to bake and sell?**
A. chocolate chip
B. Thin Mints
C. oatmeal
D. sugar

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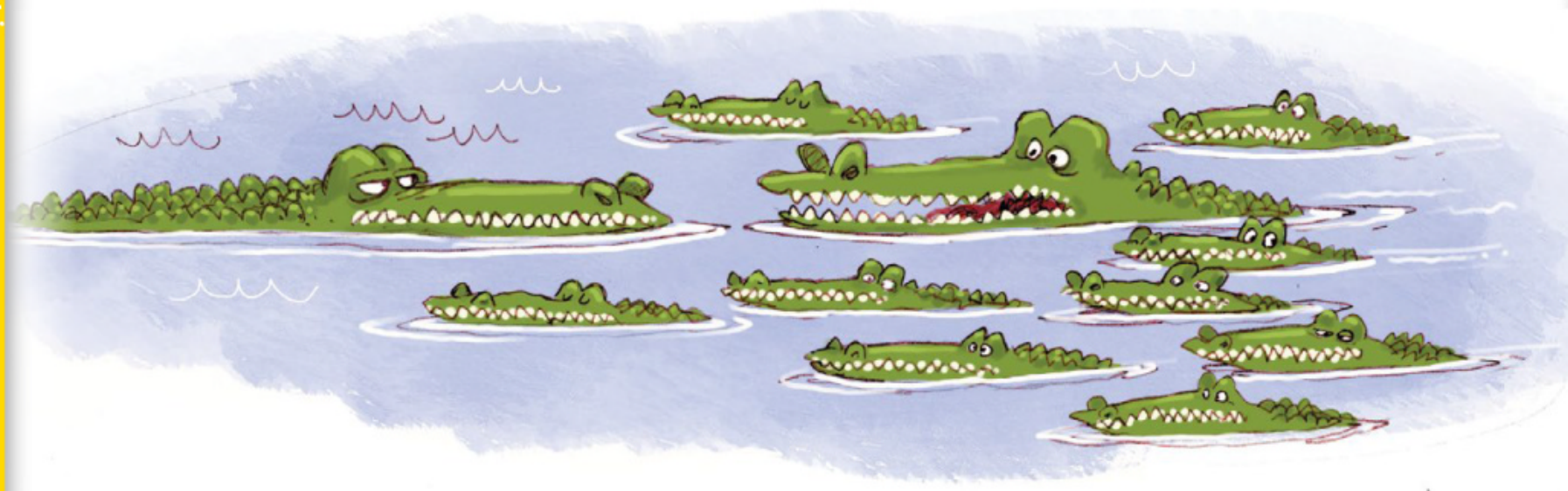
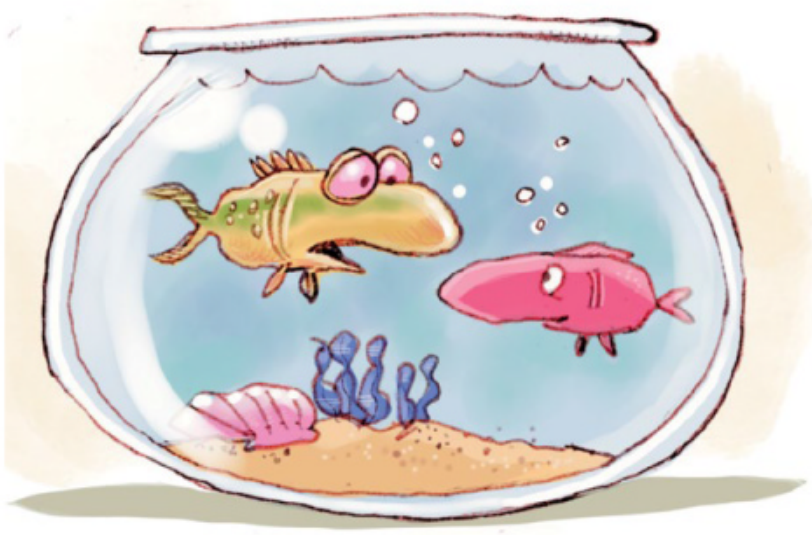
LAUGH OUT LOUD



"BAD NEWS. THE DENTIST SAID THE KIDS NEED BRACES."

"YOU'RE THE FIRST HORSEFLY I'VE EVER MET!"

"FORGET THE GPS—LET'S JUST FOLLOW THEM."



"I KNOW THIS IS GOING TO SOUND WEIRD BUT ... I'M KINDA THIRSTY."

CHRIS WARE

Answers

"Galaxy Quest" (pages 28-29):

"What in the World?" (page 30): **Top row:** surfboards, Great Barrier Reef, kangaroo. **Middle row:** cassowary, boomerang, Uluru. **Bottom row:** flag, koala, Sydney Opera House.

"Stump Your Parents" (page 32): **1.** D, **2.** A, **3.** B, **4.** B, **5.** C, **6.** C, **7.** B, **8.** B, **9.** A, **10.** D.

"Find the Hidden Animals" (page 34): **1.** C, **2.** B, **3.** E, **4.** D, **5.** A, **6.** F

FIND THE HIDDEN ANIMALS

Animals often blend in with the environment to mask their identity. Find each animal listed below in one of the pictures. Write the letter of the correct photo next to each animal's name.

ANSWERS ON PAGE 33

1. pygmy seahorse _____
2. proboscis bat _____
3. stone grasshopper _____
4. gray wolf _____
5. lion _____
6. European hare _____

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ZEUS THE MIGHTY

Zeus the hamster lives with his friends at a pet rescue center. But *he* thinks he's a Greek god! Check out what happens when his two worlds collide, then go online to learn more about the book *Zeus the Mighty: The Maze of the Menacing Minotaur*. **ZeusTheMighty.com**

1
ZEUS THE HAMSTER STUMBLES ON AN EMPTY CITY.
WOW! THIS CITY LOOKS BRAND NEW! MY LOYAL SUBJECTS MUST HAVE BUILT IT JUST FOR ME.
I WONDER WHAT WONDERS AWAIT ME ...

2
THIS CITY ... IS SO ... STAIR-Y. IF ... IT WEREN'T ... FOR MY GODLY ENDURANCE ... ALL THESE STAIRS ... WOULD BE A PROBLEM.
AND WHY WOULD SOMEONE PAINT A PICTURE OF ATHENA, A LESSER GREEK GOD, IN MY CITY?
MY PICTURE SHOULD HANG THERE!

3
ZEUS REACHES THE TOP ...
YOU CAN SEE ALL OF GREECE FROM UP HERE!
THERE'S EVEN A FLUFFY PILLOW TO RELAX UPON AS I SURVEY MY KINGDOM.

4
AH ...
MY SUBJECTS FINALLY GOT SOMETHING RIGHT. THANK—WELL, THANK ME!

5
EXCUSE ME ...
HUH?

6
WHOA!

7
... I THINK YOU'RE A BIT LOST, PAL.
ZEUS—THESE CAT TREES ARE FOR KITTIES LIKE ATHENA.
LET'S GET YOU BACK TO YOUR CRATE.
YOU MEAN I CLIMBED ALL THOSE STAIRS FOR NOTHING?
WHAT WILL ZEUS, ATHENA, AND THE OTHER PETS AT THE CENTER GET UP TO NEXT TIME? FIND OUT IN THE NEXT ZEUS THE MIGHTY!

CHECK OUT THE BOOK!